

Reconstructive Operations on the Biliary Tract

WILLIAM P. LONGMIRE, JR., M.D. and
CHARLES E. ENGEL, M.D., Los Angeles

RECONSTRUCTIVE PROCEDURES to establish the flow of bile into the alimentary tract may be indicated in the following conditions: When injuries to the common or hepatic ducts are recognized and repaired at the time of the initial surgical procedure; when secondary repair follows unrecognized trauma of the main biliary channel, unsuccessful primary repair, or obliterative extrahepatic cholangitis after operation on the biliary tract; and when treatment of malignant neoplasms involves some portion of the extrahepatic biliary system.

Cole, Reynolds and Ireneus² estimated that approximately 80 per cent of the benign strictures of the common duct are due to operative injury of the duct, usually during cholecystectomy, and less frequently during subtotal gastrectomy. The precautions that should be exercised during these procedures to protect the common duct from injury have been repeatedly emphasized. Johns³ presentation of this subject is particularly illuminating.

There is general agreement that restoration of the function of the sphincter of Oddi is desirable in choledochoplasty and, whenever possible, the continuity of the biliary tract should be reestablished by an end-to-end anastomosis of the duct above and below the point of obstruction. When conditions are such that it is technically impossible to perform such a repair, an anastomosis of the proximal duct to a defunctionalized segment of the jejunum is the next choice. Anastomosis of the proximal duct to the intact duodenum or a functioning jejunal loop has also been successful in many cases. In previous publications^{4, 5, 6} the use of intrahepatic cholangiojejunostomy was recommended for extensive benign obstruction of the extrahepatic biliary system if the usual methods of reestablishing biliary-enteric continuity proved to be inadequate.

Excision of the duodenum or the head of the pancreas for neoplasms entails the removal of a portion of the common duct, in which case some type of biliary-enteric anastomosis must be performed. End-to-side choledochojejunostomy is the technique usually employed.

From the Department of Surgery, University of California Medical Center, Los Angeles, Wadsworth Hospital, Veterans Administration Center, Los Angeles and the Los Angeles County Harbor General Hospital, Torrance.

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Fifty cases in which reconstruction of the biliary system was carried out were reviewed. In 25 cases the operation was done during the treatment of malignant neoplasms. The other 25 patients were treated for benign conditions. Delayed stricture of the biliary anastomosis occurs more frequently following operation for benign post-traumatic obstruction than following reconstruction for other conditions. This is probably a result of: (1) greater regional scarring, (2) local infection, and (3) technical imperfections in the reconstituted biliary anastomosis.

Certain primary malignant tumors may be difficult to recognize by both gross and microscopic examination. In six cases of biliary obstruction resulting from malignant neoplasms in the present series, exploration had been carried out some time previously, and in four of them an erroneous diagnosis of benign biliary obstruction was made.

End-to-end anastomosis of the duct above and below the point of obstruction is the method preferred in the treatment of benign biliary stricture. Intrahepatic and extrahepatic biliary-enteric anastomoses have been used successfully in selected cases.

Bowers¹ recently reported a series of 14 cases in which the common duct was transected and reimplanted into the duodenum in the treatment of relapsing pancreatitis. Incomplete biliary drainage was encountered in only one of these patients.

MATERIAL

This report presents experiences with reconstructive procedures of the biliary tract in 50 patients. Benign biliary obstruction was present in 25 of them, and reconstruction was done in 25 others during the surgical treatment of a malignant neoplasm of the extrahepatic biliary system or of adjacent organs. These patients were treated at the Wadsworth Veterans Hospital, the Los Angeles County Harbor General Hospital, or in the private practice of the authors.

Male patients predominated in this series because of the number of cases included from the Veterans

TABLE 1

Type of Operation	Carcinoma of the Pancreas	Carcinoma of the Ampulla	Carcinoma of the Gallbladder or Common duct	Other Malignancy	Chronic Pancreatitis	Primary Trauma	Secondary Stricture	Total
Pancreatoduodenectomy.....	7	4	2	3	5	....	....	21
End-to-end anastomosis.....	....	....	1	....	....	2	10	13
Hepaticojejunostomy.....	....	....	2	....	....	....	1	3
Choledochoduodenostomy.....	....	....	3	1	....	....	....	4
Choledochojejunostomy.....	....	....	1	....	....	....	1	2
Cholangiojejunostomy.....	....	....	....	....	....	....	6	6
Other.....	....	....	2	....	....	1	....	3
Total.....	7	4	11	4	5	3	18	52

Hospital. In the private and county hospital cases, ten benign strictures to one malignant obstruction was the average ratio encountered in the female patients, while in the male patients the ratio was six obstructions due to malignant lesions to three benign obstructions.

The average age of 19 patients with trauma to or stricture of the biliary tract was 41.2 years. In the five cases in which surgical treatment for pancreatitis required biliary reconstruction, the average age was 45.6 years. There were 15 patients with primary malignant tumors of the extrahepatic biliary system. The average age for this group was 55.3 years. In seven cases of carcinoma of the pancreas the average age was 62.7 years, the oldest group of patients in the series. The average age of the four patients in whom reconstructive biliary operation was utilized in the treatment of malignant lesions of adjacent organs was 38.8 years. This was the youngest group in the series.

TREATMENT

A pancreatoduodenectomy or "Whipple" operation was done in 21 instances, for the following conditions: Carcinoma of the head of the pancreas, in seven cases; carcinoma of the ampulla of Vater, four cases; carcinoma of the common duct, two; carcinoma of the duodenum, one; other types of carcinoma, two; chronic pancreatitis, five. In all these cases the end of the common or the hepatic duct was anastomosed to the side of the jejunum or the third portion of the duodenum.

An end-to-end anastomosis of the bile duct was used in 13 operations for the following conditions: Ten for stricture secondary to surgical trauma, two for primary trauma, and one for carcinoma of the common duct. Two patients in this series had two end-to-end anastomoses for recurrent stricture.

Hepaticojejunostomy, using a Roux-Y jejunal limb, was done in three cases, in one case each of carcinoma of the gallbladder, carcinoma of the common duct and benign stricture. Hepaticoduodenostomy was used on one occasion, in a patient with lymphosarcoma involving the common duct. Choledochoduodenostomy was used in three patients

with carcinoma of the common duct and in one with carcinoma of the stomach. The common duct was anastomosed to a jejunal loop in one patient with carcinoma of the stomach, to a Roux-Y jejunal limb in one patient with a benign stricture, and to the stomach in one patient with carcinoma of the common duct. The series includes six patients in whom cholangiojejunostomy was done. Removal of a ligature about the common duct and insertion of a T-tube was done in one case (see Table 1).

RESULTS

Carcinoma of the Pancreas. Seven patients with carcinoma of the head of the pancreas were treated by means of pancreatoduodenectomy with end-to-side anastomosis of the biliary tract to the jejunum or third portion of the duodenum. Results in the treatment of this disease have been as discouraging as those reported by others. Only two of these patients escaped serious immediate postoperative complications. Four of the patients survived two months or longer and all died within a year of the date of operation. In two cases biliary fistulas developed during the immediate postoperative course. It is interesting, however, that those who survived four months or longer did not experience difficulties with the biliary-enteric anastomosis until there was evidence of recurrent carcinoma. Delayed benign stricture of the anastomosis was not encountered.

Carcinoma of the Ampulla of Vater. Pancreatoduodenectomy was used in four patients with carcinoma of the ampulla of Vater. One patient died during the postoperative period, while the remaining three lived for over four months. Three years after operation one of the latter died of recurrent carcinoma. Stricture or obstruction of the biliary anastomosis did not occur in any of these cases.

Carcinoma of the Extrahepatic Biliary System. Biliary reconstruction of some type was attempted on ten patients with carcinoma of the bile ducts and on one with carcinoma of the gallbladder. Due to the extensive character of the neoplasm, only a palliative rather than a curative procedure could be performed on nine of these patients.

TABLE 2—Neoplasms of the biliary system

CANCER OF THE BILE DUCTS						
Case	Result Expected	Immediate Post-operative Course	Survival Time	Remarks:	Type of operation	No. of operations
1.	Curative	Good	4 yrs. 3 mo.	Died of recurrent cancer	Whipple	1
2.	Curative	Good	3 yrs. 1 mo.	Alive and well	Whipple	2
3.	Palliative	Good	4½ mo.	Alive and well	End-to-end	2
4.	Palliative	Good	2 yrs. 6 mo.	Died at 84, recurrent cancer	Hepatico-jejunostomy	3
5.	Palliative	Good	4 mo.	Died, extensive cancer	Choledocho-duodenostomy	1
6.	Palliative	Good	1 yr. 5 mo.	Died, general tuberculosis	Choledocho-duodenostomy	1
7.	Palliative	Complicated	7 days	Duodenal fistula, peritonitis	Choledocho-duodenostomy	2
8.	Palliative	Complicated	18 days	Extensive cancer, steady downhill course	Choledocho-jejunostomy	1
9.	Palliative	Complicated	8 mo.	Died, extensive cancer	Choledocho-gastrostomy	2
10.	Palliative	Complicated	6 weeks	Alive, receiving x-ray	Hepatico-duodenostomy	3
CANCER OF THE GALLBLADDER						
11.	Palliative	Complicated	1 day	Died, shock and hemorrhage	Hepatico-jejunostomy	1

A "curative" procedure was performed on the two patients whose carcinoma was small and located in the distal end of the common duct, within the head of the pancreas. Pancreatoduodenectomy was done and in both cases the immediate postoperative course was uneventful. One patient lived four years and three months before dying of recurrent carcinoma. The other patient was alive and well without evidence of disease 37 months after operation.

Table 1 indicates the variety of procedures that have been used to divert the flow of bile from the proximal ductal system around the obstructing neoplasm and into the alimentary tract. Anastomosis of the gallbladder to the intestine has not been used in any of these patients because of obstruction above the junction of the cystic and hepatic ducts or because the gallbladder had been previously removed. There were two deaths in the period immediately after operation. One patient who was gravely ill with carcinomatosis died 18 days after operation. Two patients were alive and well at the time of this report, one six weeks and the other four and a half months after operation. One of these patients is receiving roentgen therapy, as the obstructing neoplasm is a lymphosarcoma. Two patients had good palliation for over a year, although one of them eventually died of generalized tuberculosis. Two other patients found to have very extensive carcinomatosis at operation died within a few months without receiving appreciable benefit from the procedure. Postoperative biliary obstruction, when it occurred in these cases, resulted from extension of the neoplasm and not from benign scarring or stricture (Table 2).

Carcinoma of Adjacent Organs. Biliary reconstruction was done in four cases during extensive resections of neoplasms of adjacent organs. The neoplasms originated in the stomach in two patients, the colon in one patient, and in the duodenum in another. None of these patients survived the extensive resections beyond the immediate postoperative period.

Chronic Pancreatitis. Five patients with localized chronic pancreatitis were treated by pancreatoduodenectomy with an end-to-side biliary-enteric anastomosis. There were no deaths in this group up to the time of this report, and in only one patient were there serious complications following operation. The biliary-enteric anastomosis functioned without difficulty in all cases. One patient has been observed for four years since operation (Table 3).

Primary Trauma. Three patients were observed soon after the original trauma to the duct. In two cases the trauma was recognized and repaired by end-to-end anastomosis at the time of injury. In the third case exploration was carried out a few days following the original operation. An occluding ligature was removed from an intact common duct, and a T-tube inserted. A stricture which developed 11 months following this procedure required excision and end-to-end anastomosis.

One of the two patients in whom primary anastomosis was performed also had a division of the hepatic artery. The duct and the artery were repaired by end-to-end anastomosis but the patient died of hepatic failure. Severance of the common duct was identified at the time of cholecystectomy in the second case, and careful end-to-end anasto-

mosis over a small T-tube was carried out. The T-tube became obstructed five weeks after operation and was removed, but in a period of two and a half months of observation after operation the patient did well (Table 4).

Secondary Benign Stricture. There were 18 operations on 16 patients in this group. End-to-end anastomosis was done ten times and hepaticojejunostomy and choledochojejunostomy once each. Cholangiojejunostomy has been used in six cases. All of the eight patients treated by end-to-end anastomosis were in satisfactory condition at the time of this report, although reoperation was required in two of these cases. Two patients were relieved of biliary obstruction by a biliary-enteric anastomosis.

Cholangiojejunostomy brought about satisfactory biliary drainage in three patients. One patient remained jaundiced, however—supposedly from severe cirrhosis, since roentgenograms showing drainage of the left and right lobes demonstrated the patency of the anastomosis. Two other patients died after operation, both of continued biliary difficulties. One of them obtained satisfactory biliary drainage after operation but he continued to have moderately severe attacks of cholangitis every three to six months. Death occurred following reexploration of the liver hilus at another hospital six years after the cholangiojejunostomy. Autopsy disclosed multiple stones in the hepatic ducts. The operation failed to produce drainage of bile into the intestinal tract in only one patient. This patient had an external biliary fistula and the intrahepatic ducts were not greatly dilated. The external fistula persisted after operation. Further surgical procedures were refused and death occurred 13 months after operation (Table 5).

DISCUSSION

Extrabiliary lesions such as carcinoma of the pancreas, or chronic pancreatitis frequently cause dilation of the biliary tract and thickening of the wall of the duct. When a partial resection of the common duct is required in such cases, a sizable proximal segment of the duct usually remains and biliary-enteric anastomosis can be performed without undue technical difficulty. The absence of cholangitis in such cases is another factor which is undoubtedly important in explaining why benign secondary strictures did not form at the site of biliary anastomosis in cases of this type in the present series. On the other hand, there was a history of recurrence of an anastomotic stricture following reconstructive procedures for traumatic stricture in ten of sixteen cases.

If trauma to the duct occurs, the optimum conditions for a successful repair are undoubtedly present at the time of the original operation.

TABLE 3—Pancreatitis

Case No.	Immediate Postoperative Course	Survival Time	Remarks
1	Uneventful	4 yrs.	General condition good. 30 lb. weight gain. Occasional cramps and diarrhea.
2	Uneventful	7 mo.	Condition satisfactory. Gain in weight.
3	Uneventful	3 yrs. 8 mo.	Satisfactory
4	Complication of intraperitoneal abscesses	4 mo.	Improving
5	Uneventful	1½ mo.	Improving (diabetes)

TABLE 4—Primary trauma

Case No.	Operation	Results
1	Removal of ligature of common duct Insertion of T-tube.	Tube remained 3½ weeks. Stricture occurred 11 mo., later requiring reoperation.
2	End-to-end anastomosis	Died of hepatic failure. Had also sustained injury of hepatic artery.
3	End-to-end anastomosis	Tube removed in 5 weeks. Condition satisfactory 2½ months postoperatively.

Subsequent scarring of the duct wall and adjacent tissues and local infection, conditions which are invariably associated with secondary repairs, contribute greatly to the failure of subsequent operations for biliary reconstruction.

Leakage at the biliary anastomosis did occur during the early postoperative period in three cases following pancreatoduodenectomy and caused serious postoperative complications. A well-supported anastomosis must be carefully done, using two rows of interrupted sutures. Beyond the immediate postoperative period the results of biliary reconstruction, *per se*, have been good in the extrabiliary lesions.

A "curative" operation could be done in only two of eleven cases of carcinoma of the extrahepatic biliary system. In both of these the lesions were in the distal portion of the common duct and were treated by pancreatoduodenectomy. The first patient died of recurrent carcinoma four years and three months after operation. Three years and one month after operation the second patient was well and without evidence of recurrence.

Certain malignant tumors arising in or involving the common duct are characterized by the formation of abundant fibrous or scar tissue. It may be difficult to establish the correct diagnosis of such tumors since the malignant character of the tissue may not be noted in histological studies of frozen sections. In six of the eleven cases exploration had been done elsewhere prior to the operations considered in the present series. In four of these six cases an

TABLE 5—Benign strictures

Case No.	No. of operations	Operation performed	Immediate result	Tube removed	Follow-up period	Present Condition
1	1	End-to-end	Good	42 days	15 mo.	Good, two episodes cholangitis
2	2	End-to-end	Good	27 days	9 mo.	Excellent
3	1	End-to-end	Good	7 weeks	Reexploration for biliary obstruction date unknown	Satisfactory
4	3	End-to-end	Good	5 months		Obstruction recurred after removal of tube
*	4	End-to-end	Good	4½ months	3½ yrs.	Good, occasional cholangitis
5	2	End-to-end	Good	1 year	5 yrs.	Satisfactory
6	2	End-to-end	Satisfactory		4 yrs.	Good, occasional mild cholangitis
7	1	End-to-end	Good	3 months		Recurrent obstruction at 6 months
*	2	End-to-end	Good	3 months	3 yrs. 7 mo.	No obstruction. Has antral gastritis
8	1	End-to-end	Good	4 months	7 yrs.	No obstruction. Diag. duodenal ulcer
9	1	Hepatico-jejunostomy	Satisfactory cont. pain	6 weeks	7 weeks	No fever. Jaundice cleared. Cont. pain, addiction
10	2	Choledocho-jejunostomy	Good		5 yrs. 5 mo.	Satisfactory
11	4	Cholangio-jejunostomy	Fair		13 mo.	Died. Biliary drainage not satisfactory
12	4	Cholangio-jejunostomy	Good		4 yrs. 3 mo.	No obstruction. Various abd. complaints
13	2	Cholangio-jejunostomy	Good		3 yrs. 4 mo.	Excellent
14	4	Cholangio-jejunostomy	Satisfactory until 12th day		Hemorrhage, Esophageal varices	Died
15	4	Cholangio-jejunostomy	Good		4 yrs.	Partial jaundice persists. Severe cirrhosis. Anas. patent
16	5	Cholangio-jejunostomy	Good		6 yrs.	Intermittent cholangitis. Died after reexploration of hilus. Intrahepatic stones found at autopsy

* (Reoperation)

incorrect diagnosis of benign stricture or obliterative cholangitis had been made.

These fibrous neoplasms grow slowly, and they produce no symptoms other than of biliary obstruction for long periods of time. One patient in the present series lived comfortably for over two years following relief of biliary obstruction by a "side-tracking" procedure. We have not had occasion to perform cholangiojejunostomy for this type of neoplasm but it might be indicated in certain cases, as has been suggested by Waddell and Burbank.⁷

The tumor was much less favorable in its growth characteristics in four of the cases herein. There was wide extension of the tumor at the time of exploration and, despite various diverting procedures, the patient's condition continued to deteriorate. The longest survival period was eight months.

End-to-end anastomosis of the duct above and below the obstruction has been the preferred method of treating benign biliary stricture. Two of the patients with benign stricture underwent reexploration. Two patients were treated with biliary-enteric anastomosis. Drainage was satisfactory in all of these patients at the time of this report.

Following failure of the usual methods of reconstruction, cholangiojejunostomy was used in six of

the present cases. This procedure has been of definite benefit and should not be withheld until repeated obstructions have brought about advanced biliary cirrhosis. Two unsuccessful attempts by competent surgeons to repair the ductal system at the hilus should be sufficient indication to consider the use of cholangiojejunostomy.

U.C.L.A. School of Medicine, Los Angeles 24.

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